

## **Chemical and technological characteristics of large leaf tobacco Virginia 0842**

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### **Abstract**

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The study was performed in the region of the town of Parvomay and the region of the town of Dolni Dabnik under production conditions. Assessment was made of the quality characteristics of the resulting tobacco raw materials from a new variety of large leaf tobacco Virginia 0842. The main physical characteristics of the dry tobacco were established. Studies were made of the chemical values of nicotine, soluble sugar, total nitrogen, protein substances, ashes and chlorine in tobacco. The results show high nicotine values to 3.78% and very high content of soluble sugars varying between 12 and 28%.

*Keywords:* Virginia tobacco; new variety; quality characteristics; chemical characteristics

### **Introduction**

The different ecological, weather and soil conditions in Bulgaria are a prerequisite for a large number of different varieties with specific quality characteristics determining their smoking and taste properties. This high number of different varieties was the distinctive feature of Bulgarian tobacco. After the cancellation of the regional division in tobacco growing the characteristics of typical smoking qualities of tobacco were lost. Growing everywhere a limited number of commercial high-yielding varieties outside their typical regions led to reduction of the quality of tobacco as a consumer product.

The tobacco from the Virginia variety group is the most grown in the world and the main ingredient used in the production of cigarettes of the American blend and Virginia blend type (Apostolova, 1991, 1997; Bruce et al., 1991; Blake Brown, 2004; Risteski & Kocoska, 2014).

Virginia tobaccos were first introduced in Bulgaria in the region of Maglzh in 1937. The results were quite promising and its production started to grow. In the 40s the Hanza type curing barns were used in Plovdiv, Stara Zagora, Vidin and Pleven regions (Ralovski & Chinchev, 1991; Ralovski, 1993, 1996).

Because of the interest towards this tobacco, production and curing technologies gradually improved. Large – scale tobacco production and bulk curing began in the early 70s, while the construction of Bulgarian made curing barns started in the mid 70s.

The curing and processing capacity of the country in this period came to 25 thousand tons. The annual production of Virginia tobacco varies between 15 – 25 thousand tons depending on a manufacturers' demand

Currently the curing capacity is for 15 thousand tons. Virginia tobaccos with the following characteristics are produced in the country mainly for domestic consumption:

Nicotine content – 1.2 – 2 per cent

Sugar content – 15 – 20 per cent

Chlorine content – 0.5 per cent

There are regions in the country, where soils and climate are suitable for production of 4 – 5 thousand tons high quality Virginia tobacco with a high content of nicotine.

Cultivation of tobacco of the Flue-Cured Virginia variety group is centered in the Thracian Plain, located in Southern and Central Bulgaria, and the Danube Plain (Fig. 1), which constitutes the northern part of the country. Over the last few



**Fig. 1. Regions of tobacco growing from the Virginia variety group in Bulgaria.**

years, a major part (85%) of the Virginia production comes from the Thracian Plain (Bozukov et al., 2018).

To date, several foreign varieties of the Virginia variety group (PVH-1, PVH-2023, Hevesi) and only two Bulgarian varieties – Virginia 0454 and Virginia 0514 are grown in Bulgaria (Official List of Varieties in Bulgaria, 2020); they partially meet the requirements of producers and traders. This makes it necessary to study and offer new varieties from the Virginia variety group with improved quality and quantity characteristics. An important requirement is the early ripeness of large leaf tobacco varieties. The arguments in favour of this are a decisive for the increase of production effectiveness (Chinchev & Stoyanov, 1985, 1987, 1991).

The Tobacco and Tobacco Products Institute has some varieties of Virginia tobacco lines with similar qualities that are ready for official recognition; such a variety is Virginia 0842.

Virginia 0842 is a consolidated line created in the Tobacco and Tobacco Products Institute by Chinchev by hybridization between the varieties Virginia D, Virginia 385. The height of the plant is 165-178 cm. The number of leaves is 28. The vegetation period from planting to mass flowering is 68-72 days. The line is resistant to PVY (Chinchev & Stoyanov, 1989). Chemical composition of tobacco: nicotine content – 1.43-2.77%, soluble sugars – 6.18-20.20%, total nitrogen – 1.65-3.02% (Drumeva, 2020).

The main purpose of the study is to assess the quality characteristics and determine the basic physical properties of the tobacco raw material from the applicant-variety Virginia 0842, grown under production conditions in different country regions. The basic chemical characteristics of raw tobacco should be determined. There should be evidence of

the adaptation of a new variety of large leaf tobacco in typical growing regions.

## Materials and Methods

In 2018 – 2019 it was planned to grow and observe Virginia 0842 tobacco under production conditions in two country regions that are different in terms of their soil and climate properties- Parvomay (South Bulgaria) and Dolni Dabnik (North Bulgaria). The following activities were performed in order to achieve the purpose of the study:

- Determining the stage of technical ripeness of tobacco from different regions in Bulgaria.
- Finding suitable curing regimes.
- Forming average tobacco samples for technological and chemical analysis.
- Quality characterization of cured tobacco.
- Determining basic chemical values of tobacco.

The chemical tests were performed with representative average samples in the accredited testing laboratory complex of the Tobacco and Tobacco Products Institute, Markovo village. The content of nicotine and soluble sugars were tested with standardized methods:

– ISO 15152:2003 – Tobacco – Determination of the content of the total alkaloids as nicotine – Continuous-flow analysis method.

– ISO 15154:2003 – Tobacco – Determination of the content of reducing carbohydrates – Continuous-flow analysis method.

## Results and Discussion

Data of average monthly temperature and precipitation in the country for 2018-2019 (Table 1) during the vegetation period (May-September) show insignificant difference in the parameters for the two years of study. They are typical for the country and are not the optimal ones for the production of large leaf tobacco (Donev et al., 1981). This requires the application of a clearly set technology of cultivation under irrigated conditions in order to ensure normal conditions for development and good tobacco produce for the Virginia variety group because the best precipitation in this period (May-September) for large leaf tobacco is 650-800 liters.

Virginia 0842 was observed in the region of the town of Parvomay and the town of Dolni Dabnik. Table 2 shows the results with class ratio after production treatment of tobacco.

Cured tobacco of the Virginia 0842 variety from Parvomay has better quality and technological values.

Tables 3 and 4 show the results from the testing of basic physical characteristics of Virginia 0842 tobacco. The data

**Table 1. Average monthly temperatures and precipitation for the country – 2018-2019**

| Month     | Average monthly temperature, °C |      | Precipitation per month, liters |       |
|-----------|---------------------------------|------|---------------------------------|-------|
|           | 2018                            | 2019 | 2018                            | 2019  |
| Year      |                                 |      |                                 |       |
| May       | 16.2                            | 17.4 | 61.1                            | 57.4  |
| June      | 21.1                            | 19.5 | 102.1                           | 134.6 |
| July      | 22.1                            | 21.4 | 99.5                            | 103.9 |
| August    | 22.9                            | 22.5 | 21.3                            | 18.8  |
| September | 19.1                            | 17.8 | 20.5                            | 18.9  |

Data from the National Institute of Meteorology and Hydrology

**Table 2. Quality characteristics of Virginia 0842 tobacco**

| Variety                     | Class, %        |                  |                   |
|-----------------------------|-----------------|------------------|-------------------|
|                             | I <sup>st</sup> | II <sup>nd</sup> | III <sup>rd</sup> |
| Virginia 0842-Parvomay-2018 | 25              | 60               | 15                |
| Virginia 0842-Parvomay-2019 | 20              | 55               | 25                |
| Virginia 0842-D.Dabnik-2019 | 15              | 50               | 35                |

confirmed that the values of density of cured tobacco and the conditional cigarette output are very good.

The leaves have a good length/width ratio that is typical for Virginia tobacco.

The shape of the largest leaf of the tobacco plant is broad and elliptic with the following dimensions of leaf 7: length to 54–55 cm and width to 34 cm. The leaf blade is slight-

ly puckered, covered with hairs, of average density, with smooth periphery. The leaves have uniform colour – bright yellow to orange. They have very good elasticity, high density and strength (Ibrahim et al., 1984).

The results in Table 3 and Table 4 show that dry tobacco from both crops – 2018 and 2019 has very good technical values for class I and II. Leaf blade thickness is about 0.01 g/cm and leaf density is 0.56g/cm<sup>3</sup>. Such values show excellent density of cut tobacco to 0.19 g/cm<sup>3</sup> and conditional cigarette output of about 1700 cigarettes from one kilogram of cured tobacco.

The values of basic technological characteristics of the new variety Virginia 0842 are better than the ones of the two basic varieties of large leaf tobacco Virginia 0454 and Virginia 0514 which hold the main share of the quota of the Virginia variety group cultivated in Bulgaria in recent years.

Tobacco is a specific product for consumption, mainly by smoking and to a very small degree by chewing and sniffing. The chemical composition of tobacco is too complex because the plant leaves are consumed (Miller & Hensley, 2010). That is what directly determines the consumption properties of tobacco and its physiological effect on human organism.

The results (Tables 5 and 6) show that tobacco class I of Virginia 0842 from the region of the town of Parvomay and the town of Dolni Dabnik is with the highest percentage of nicotine. Nicotine content is different depending on the region of production. The typical Virginia contains about 2

**Table 3. Physical characteristics of Virginia 0842 tobacco-2018**

| Description of sample | Number of leaves per kg tobacco | % of main nerve | Length/width, cm | Thickness of leaf blade, g/cm | Weight of a single leaf surface, g/cm <sup>3</sup> | Density of tobacco leaves, g/cm <sup>3</sup> | Density of cut tobacco, g/cm <sup>3</sup> | Conditional cigarette output, number of cigarettes/kg tobacco |
|-----------------------|---------------------------------|-----------------|------------------|-------------------------------|--|--|---|---|
| Parvomay-class I      | 81                              | 25.33           | 57.0-21.9        | 0.01060                       | 0.0085   | 0.760  | 0.170                                     | 1760  |
| Parvomay-class II     | 92                              | 26.22           | 59.5-21.6        | 0.01042                       | 0.0079   | 0.800  | 0.189                                     | 1550  |

**Table 4. Physical characteristics of Virginia 0842 tobacco -2019**

| Description of sample | Number of leaves per kg tobacco | % of main nerve | Length/width, cm | Thickness of leaf blade, g/cm | Weight of a single leaf surface, g/cm <sup>3</sup> | Density of tobacco leaves, g/cm <sup>3</sup> | Density of cut tobacco, g/cm <sup>3</sup> | Conditional cigarette output, number of cigarettes/kg tobacco |
|-----------------------|---------------------------------|-----------------|------------------|-------------------------------|--|--|---|---|
| Parvomay-class I      | 83                              | 26.46           | 57.3-22.1        | 0.01051                       | 0.0081   | 0.767  | 0.168                                     | 1764  |
| Parvomay-class II     | 95                              | 27.32           | 58.5-22.4        | 0.01030                       | 0.0083   | 0.804  | 0.192                                     | 1543  |
| D.Dabnik-class I      | 92                              | 26.36           | 53.9-22.5        | 0.01046                       | 0.0059   | 0.566  | 0.185                                     | 1602  |
| D.Dabnik – class II   | 113                             | 27.93           | 49.5-19.1        | 0.01164                       | 0.0065   | 0.556  | 0.193                                     | 1534  |

**Table 5. Chemical characteristics of Virginia 0842 tobacco-2018**

| Region<br>Class     | Characteristics |                  |                   |             |
|---------------------|-----------------|------------------|-------------------|-------------|
|                     | Nicotine, %     | Soluble sugars,% | Total nitrogen, % | Chlorine, % |
| Parvomay – class I  | 3.10            | 10.90            | 2.60              | 0.22        |
| Parvomay – class II | 2.15            | 19.10            | 2.05              | 0.36        |

**Table 6. Chemical characteristics of Virginia 0842 tobacco-2019**

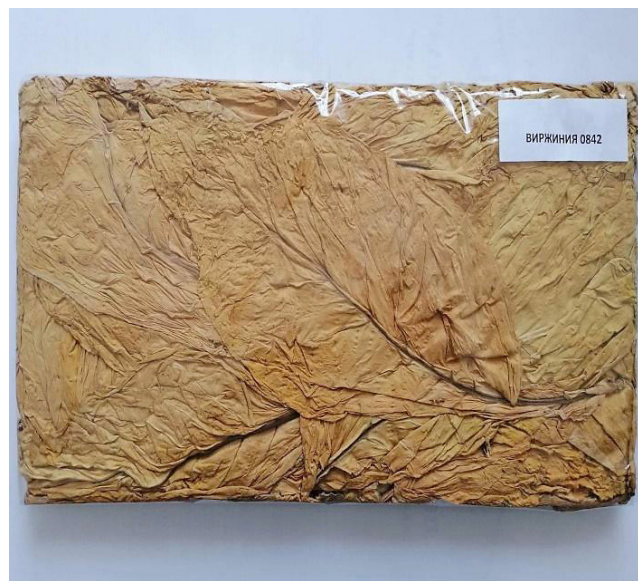
| Region<br>Class     | Characteristics |                      |                      |                |             |                          |                 |
|---------------------|-----------------|----------------------|----------------------|----------------|-------------|--------------------------|-----------------|
|                     | Nicotine,<br>%  | Soluble<br>sugars, % | Total<br>nitrogen, % | Chlorine,<br>% | Ashes,<br>% | Protein<br>substances, % | Shmuk<br>number |
| Parvomay – class I  | 3.78            | 11.10                | 2.81                 | 0.16           | 9.50        | 6.80                     | 1.63            |
| Parvomay – class II | 2.03            | 20.10                | 1.95                 | -              | 9.72        | 7.01                     | 2.87            |
| D.Dabnik – class I  | 2.04            | 20.60                | 2.13                 | 0.38           | 9.41        | 7.07                     | 2.91            |
| D.Dabnik – class II | 1.92            | 18.80                | 1.79                 | 0.47           | 9.61        | 6.00                     | 3.13            |

– 2.5% nicotine. The chemical composition of Virginia tobacco is mainly characterized by the high content of soluble sugars varying widely (12 – 28%). The values of soluble sugar of Virginia 0842 from the two testing regions are very high for the two classes. Ash content is low – about 9.5%, which shows that leaves have high usable content. Total nitrogen ranges within the interval of 1.79 – 2.81 %.

**Fig. 2. Virginia 0842**

The results from basic chemical values of tobacco from the Virginia 0842 variety show very high content of nicotine (over 3%) and of soluble sugars (20%). The typical Virginia contains about 2-2.5% nicotine. The Virginia 0842 variety is classified as high-nicotine in terms of nicotine content.

The Shmuk number is used for determining the objective qualities of bright leaf tobacco. It is presented as a ratio of soluble sugars to protein substances and gives the objective characteristics of the taste of tobacco smoke (Srbinska, 2012). A taste with well-presented fullness, harmony and smoothness, without burning, irritation and sharpness, is achieved with values of the Shmuk number to 3.0. With higher values the taste is characterized with one-sidedness, without fullness and harmony. The results in Table 6 show

**Fig. 3. Commercial sample of Virginia 0842**



that the values of the Shmuk number are 1 – 3 for class I and II.

The ratio of high nicotine values to soluble sugars and Shmuk number to 3 are the prerequisites for smoking properties with balanced taste, sufficient fullness and physiological strength for tobacco of the Virginia 0842 variety.

Lots of tests proved the negative effect of chlorine on tobacco flammability, but with Virginia 0842 chlorine values are exceptionally low – to 0.5%.

Ash content in dry tobacco leaves varies from 8 to 30%. It is directly linked to the material properties of leaves and the curing method. The high-quality, quickly cured tobacco contains low quantities of ash – usually to 10 – 12%. With Virginia 0842 ash content is below 10%.

## Conclusions and Recommendations

Tobacco quality is mainly determined by variety characteristics as well as by the place, conditions and method of growing. The values of the main chemical indicators directly depend on the technology of tobacco treatment and processing. The specific smoking properties for each tobacco type and variety are determined by definitely set chemical values of tobacco. Achieving specific smoking properties for each tobacco variety results from the observation of all technologies of growing, primary treatment, processing and the correct regional distribution of tobacco.

The effect of abrupt weather changes on the quality of cured tobacco show that it is necessary to select new tobacco varieties.

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The applicant-variety Virginia 0842 has relatively short vegetation and the quantity and quality values required for its declaration in the Patent Office for recognition as a promising new tobacco variety from the Virginia variety group.

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